significance in either case. Bowel dysfunction in ACC is frequently attributed to treatment-related toxicity, however our data support the hypothesis that dysfunction is frequently multifactorial, including disease, comorbidity, and psychosocial factors in addition to treatment factors, and that adequate baseline assessment of function is essential prior to CRT.

60

OUTCOMES OF ESOPHAGEAL CANCER PATIENTS TREATED WITH TRIMODALITY THERAPY IN A COMMUNITY HOSPITAL

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Purpose: Chemoradiation (CRT) followed by surgery has become the standard of care for the treatment of localized esophageal carcinoma. The rationale for this study was to examine survival outcomes and Quality of Life (QOL) in esophageal carcinoma patients treated with tri-modality therapy in a community cancer centre.
Methods and Materials: Patients identified between June 2010 and November 2015 with a diagnosis of adenocarcinoma or squamous cell carcinoma of the esophagus, Stage T1-4N0-3 (AJCC 7th Ed.) and undergoing tri-modality treatment were eligible for this prospective cohort study. QOL (EORTC QLQ C30) and toxicity data (CTCAE v3.0) were collected at baseline, and four weeks, six months, and yearly post-completion of CRT.
Results: Sixty patients consented to participate. Data was collected prospectively on 40 patients from diagnosis. Data was collected retrospectively for 20 patients diagnosed between June 2010 to February 2013 when consented at time of follow up, then followed prospectively thereafter. Thirty-three were treated with neoadjuvant CRT with 45-50 Gy in 25 fractions with concurrent 5FU and Cisplatin and 27 patients with 41.4 Gy in 23 fractions, with carboplatin and paclitaxel (CROSS protocol). Median age was 66 years (range: 40-78) with 90% males. Median follow up was 13 months (range 2.3-53). Baseline QOL data was collected in 38 patients in the prospective group. Pathological complete response (pCR) rates were 38% for those receiving CRT with cisplatin/5FU and 22% for those treated with the CROSS protocol. Two-year overall survival (OS) and disease-free survival (DFS) was 68% and 53%, respectively with a median survival of 28 months. No significant differences were seen in DFS or OS between the two treatment regimens (p = 0.95), nor were improved outcomes associated with achieving a pCR (p = 0.17). Median time to recurrence was 16 months, with locoregional recurrence in 17%, distant in 12% and both in 5%. No association was found between baseline global QOL and OS (HR = 0.9, 95% CI: 0.6-1.4) or DFS (HR = 0.8, 95% CI: 0.3-2.4). Additional QOL data will be presented.
Conclusions: Survival outcomes in our cohort are in line with those reported in the literature, although pCR rates in our CROSS protocol group were lower compared to the CROSS study, and with short follow up pCR was not significantly associated with better survival outcomes.

61

DOES EVALUATING DOSE TO CORONARY ARTERIES IMPROVE RISK ESTIMATES FOR LATE CARDIAC TOXICITY AFTER MEDIASTINAL RADIOTHERAPY FOR HODGKIN LYMPHOMA?

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Purpose: Radiotherapy (RT) for Hodgkin lymphoma (HL) is associated with late cardiac toxicity (LCT) as a potential complication after treatment. Risk of LCT is known to increase with increasing mean heart dose, however, it is unknown whether evaluating dose to heart substructures, such as the coronary arteries, will provide additional information to predict LCT risk. This study evaluated whether estimating dose to coronary arteries (CA) provided additional explanatory information for LCT compared to estimating whole heart dose alone.
Methods and Materials: LCT status of 599 patients receiving mediastinal RT for HL at a tertiary cancer centre between 1988-2003 was determined from medical records and with linkage to a population-based hospitalization dataset. A random sample of 125 of these patients was selected and biomechanical deformable image registration was used to reconstruct 3D heart volumes from 2D imaging using validated methods. Historical RT plans were reconstructed on the 3D CT data sets and the heart and coronary arteries were contoured to estimate dose-volume variables to these structures. Principal Component analysis (PCA) was used to compare the proportion of variation in LCT explained by dose-volume variables to the whole heart versus the heart plus CA. The contribution (loadings) of different parameters (Dmean, Dmax, Dmin, V5, V10, V20, V30) to LCT occurrence was also evaluated.
Results: Forty-four cases of LCT were seen, 30 of which were ischemic; other LCT included valvular disease, arrhythmias, pericardial disease, and heart failure. Median follow up was 10.4 years (range: 0.15 – 23.8). Median Dmean to the heart, right coronary, left anterior descending, and circumflex arteries were 24.6 Gy, 29.8 Gy, 17.3 Gy, and 27.3 Gy, respectively. Both the PCA of the heart and the heart plus CA had first components that explained > 50% of the variance in LCT, and there was no substantial improvement in explanatory power by adding CA doses in addition to whole heart doses to the PCA. Within components, no single dose-volume parameter explained a large proportion of LCT (i.e. loading > 0.5): in both whole heart, and heart plus CA models, the mean heart dose contributed most to explaining LCT (loading = 0.41 and 0.25, respectively).
Conclusions: Our results indicate that estimating dose to CA will not add significant explanatory power to predict LCT in HL survivors, compared with documenting dose to the whole heart only. LCT risk in this setting may be mostly predicted by age, sex, comorbidities, and mean heart dose. However, our study may be underpowered to detect a small contribution from dose to the CA that is distinct from whole heart dose.

62

STEREOTACTIC BODY RADIOTHERAPY FOR LIVER METASTASIS: IMPACT ON SYSTEMIC THERAPY?

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Purpose: The management of patients with distant metastasis has historically been systemic therapy (ST). However, that paradigm is shifting to individually personalized care. Stereotactic body radiotherapy (SBRT) enables non-invasive ablation of liver metastases and its use is increasing despite the lack of randomized evidence. We reviewed the outcomes of liver metastases treated with SBRT at our institution, and evaluated the impact of liver SBRT on the treatment algorithm of metastatic patients on ST.
Materials and Methods: The records of 112 patients with 149 metastatic liver lesions treated with SBRT between 2011 and 2015 were retrospectively reviewed. Indications for treatment were: oligometastasis (OM) where the objective was to eradicate all sites of disease (≤5 sites); oligoprogression (OP) where only progressing lesions were treated while other sites were stable, and dominant area of progression (DAP) where a growing or symptomatic site was treated even if most or all metastatic deposits were progressing. Lesions were treated with either a 3, 5 or 6 fraction regimen delivered every other day. All patients were evaluable for response based on contrast-enhanced CT obtained at minimum of 4 months after completion of SBRT. Local control (LC), time to liver failure (TLF), time to change ST

strategy (TST), progression-free survival (PFS) and overall survival (OS) were calculated from the start of SBRT to the date of the event or last follow-up. Kaplan-Meier method was used. A univariate and multivariable Cox proportional hazard model was performed to determine predictors of outcomes. A two-tailed p-value ≤ 0.05 was considered statistically significant.
Results: The median follow-up was 14.8 months. Median age was 66.5 years. The most common primary sites were colorectal (52), breast (16), lung (12) and renal cell (6). Median BED10 was 92.7Gy (59-102). All patients were able to complete prescribed therapy. None of the patients developed Grade 3+ toxicity. For the OM subgroup (90 lesions), actuarial LC at 1 year was 79.5% (71-89%). BED10 ≥ 80 Gy (HR: 2.15, 95%CI: 1.1-4.0, p=0.0175) predicted for higher LC. The median TLF was 20 months (11-44) for OM patients. At 1 year, the probability of no change in ST strategy was 64.7% (55-74). The median TST was 11.1 months (8.2-13.9) for the entire cohort. For the OM subgroup (60 patients), the probability of no change in ST at 1 year was 82.1% (72-92) compared to the OP group (40.3%). The actuarial 1 year PFS was 42% (31-57%) for OM, and 11.8% (5-30%) for OP patients, respectively. Treatment indication predicted for higher PFS, OM vs. OP (HR: 2.16, 95% CI: 1.36-3.4, p-value 0.001). Median OS was 25.2 months (16-41). Primary colorectal cancer (p=0.0456) and treatment indication predicted for OS on univariate, but only treatment indication remained significant on multivariate analysis (OM vs. OP HR: 2.48, 95 %CI: 1.34-4.58 p=0.0037).
Conclusions: Outcomes for liver metastases treated with SBRT are favorable. Liver SBRT may delay the need to start or change ST, and warrants further prospective evaluation.

63
STEREOTACTIC RADIOSURGERY (SRS) +/- WHOLE-BRAIN RADIOTHERAPY (WBRT) FOR THE TREATMENT OF BRAIN METASTASES: A PATIENT PREFERENCE STUDY
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Purpose: The optimal management for limited, non-resectable brain metastases is an evolving area in radiation oncology. Previous data from randomized trials showed no difference in overall survival between radiation treatment with SRS and SRS + WBRT. Therefore patient preference plays an important role in decision making. This study uses a patient-centred approach to elicit patient preferences and understand what factors patients consider important in deciding which treatment to pursue.
Methods and Materials: Patients were eligible for the study if all the following criteria were met: maximum of four brain lesions, RPA class 1 or 2, and the physician believes either treatment is appropriate and maintains an equipoise when discussing treatment options. Patients were excluded if they had brain metastases that were previously treated. All enrolled patients were presented with a decision board instrument which describes the two treatments and summarizes the evidence from the major trials regarding disease control and toxicity profiles. The patients reviewed the information and were able to ask questions at the initial consultation. The patients then had the option to either take an active role or passive role in further decision making. If taking a passive role, this decision was left to the clinician. If taking an active role, they would make the decision about whether to receive SRS alone, or in combination with WBRT. All patients who took an active role in management completed a debriefing questionnaire to rank from 0-10 how important 10 factors were in making their decision.
Results: Between two centres in Canada and USA, 23 patients who were eligible to receive radiosurgery for brain metastases were enrolled in the study. All enrolled patients preferred to take an active role in deciding their treatment. The majority of patients (21/23) chose to receive SRS alone and two of 23 patients chose to receive SRS + WBRT. From the debriefing questionnaire, the highest ranked factors were quality of life (avg = 9.4, SD = 1.03), ability to maintain functional independence (avg = 9.3, SD = 0.83) and influence of treatment on survival (avg = 9.2, SD = 1.87). The least important factor was number of trips required to the cancer centre (avg = 5.0, SD = 4.22)
Conclusions: A patient-centred approach to decision making in brain metastases is feasible and the majority of patients will choose to take an active role in management if all the relevant information and evidence is presented in a clear, understandable manner. The results of this study show that the majority of patients prefer SRS alone in comparison to SRS + WBRT and rank quality of life, ability to maintain functional independence and influence of treatment on survival as highly important factors in making their decision.

64
OPTICAL SCANNER AND 3D PRINTER TECHNOLOGY TO MANUFACTURE RIGID BOLUS FOR RADIATION TREATMENT: AN INNOVATIVE APPROACH
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Purpose: Bolus is a tissue-equivalent material used in radiotherapy to increase the radiation dose delivered to the skin surface or to compensate for irregular tissue shape or missing tissue. Although using commercially available bolus material is an effective and widely used approach, significant shortcomings include an inability of standard bolus to perfectly conform to very irregular surfaces, creation of air gaps between the skin surface and bolus, availability of only limited uniform thicknesses and long setup times required to construct complex pieces of bolus material for difficult treatment areas. We aimed to address these shortcomings by using 3D printer technology in combination with an optical scanner to create precise and rigid boluses.
Methods and Materials: Detailed optical images of non-patient volunteers involved in this study were acquired using a consumer-grade optical scanner (3D Systems, Sense). A three-dimensional model of each volunteer was exported to a mesh editing software (Autodesk, MeshMixer v2.9) where the bolus was designed. The resulting bolus was exported as an STL file to software controlling the printer (Repetier-Host), converted to gcode (Slic3r) and printed on a consumer-Grade 3D printer (MakerGear, M2). Various rigid boluses were printed using polylactic acid (PLA).
Results: We used images acquired with the optical scanner to create rigid boluses for two separate regions. The first was a bolus for the nose which was straight forward to make and fit very well. The second and more complex was a bolus for the ear. In this case, we obtained a better fit by first filling the auditory canal with dental impression material. The resulting bolus had three parts, but was easily positioned and was a good fit. The field outline was printed directly onto this bolus.
Conclusions: The use of 3D printing technology shows great promise. By using the optical scanner during an initial consultation with the physician, one could eliminate the need for the patient to return for a clinical set up or mould room appointment. The printed bolus greatly reduces the skin-bolus air gap due to a personalized and tight fit to the skin surface. Any desired thickness of bolus material can be generated depending on the depth that needs to be treated and energy of radiation that is being used. We are not limited by the commercially available bolus materials, which can usually only be used in increments of 0.5 cm. Using this technology allows boluses to be made easily for complex skin surfaces. It is anticipated that the daily setup time on machine will be reduced, saving valuable treatment room time. The quality assurance process and dosimetric studies have been done and we are in the process of developing protocols for clinical